

VERDIGRIS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Cherryvale City Lake (Lake Tanko) **Water Quality Impairment: Eutrophication**

Subbasin:	Middle Verdigris
County:	Montgomery
HUC 8:	11070103
HUC 11 (HUC 14):	010 (050)
Ecoregion:	Central Irregular Plains, Osage Cuestas (40b)
Drainage Area:	Approximately 1.0 square miles.
Conservation Pool:	Area = 14.9 acres Maximum Depth = 2.0 meters (6.6 feet) Mean Depth = 0.8 meters (2.6 feet) Retention Time = 0.33 years (4.0 months)
Designated Uses:	Primary Contact Recreation; Expected Aquatic Life Support; Food Procurement
Authority:	City of Cherryvale
1998 303d Listing:	Table 4 - Water Quality Limited Lakes
Impaired Use:	All uses are impaired to a degree by eutrophication
Water Quality Standard:	<p>Nutrients - Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).</p> <p>The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation. (KAR 28-16-28e(c)(7)(A)).</p>

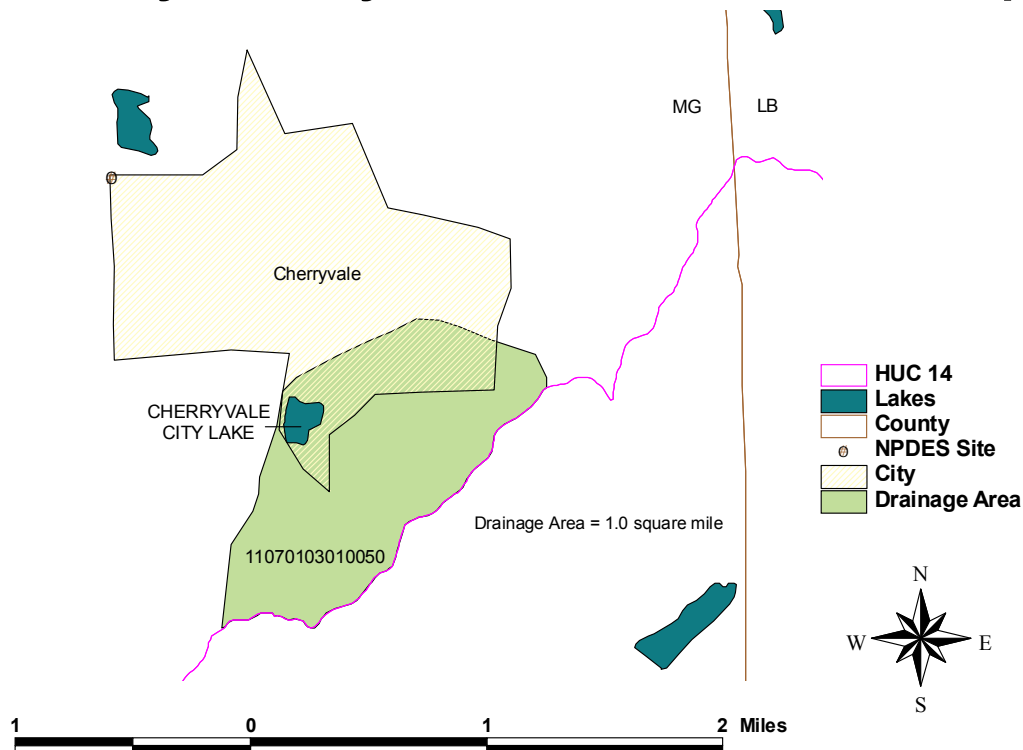
2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Hypereutrophic, Trophic State Index = 72.79

Monitoring Sites: Station 071601 in Cherryvale City Lake (Figure 1).

Figure 1

Cherryvale City Lake TMDL Reference Map



Period of Record Used: One survey in 1989.

Current Condition: The average chlorophyll a concentration was 74.0 ppb. During 1989, the average, total phosphorus concentration was 170 ppb (Appendix A). The chlorophyll a to total phosphorus yield appears high. Light is probably a limiting factor, due to clay turbidity (Appendix B).

The Trophic State Index is derived from the chlorophyll a concentration. Trophic state assessments of potential algal productivity were made based on chlorophyll a concentrations, nutrient levels and values of the Carlson Trophic State Index (TSI). Generally, some degree of eutrophic conditions is seen with chlorophyll a concentrations over 7 $\mu\text{g/L}$ and hypereutrophy

occurs at levels over 30 $\mu\text{g/L}$. The Carlson TSI, derives from the chlorophyll concentrations and scales the trophic state as follows:

- | | |
|-----------------------|-----------------|
| 1. Oligotrophic | TSI < 40 |
| 2. Mesotrophic | TSI: 40 - 49.99 |
| 3. Slightly Eutrophic | TSI: 50 - 54.99 |
| 4. Fully Eutrophic | TSI: 55 - 59.99 |
| 5. Very Eutrophic | TSI: 60 - 63.99 |
| 6. Hypereutrophic | TSI: ≥ 64 |

Interim Endpoints of Water Quality (Implied Load Capacity) at Cherryvale City Lake over 2007 - 2011:

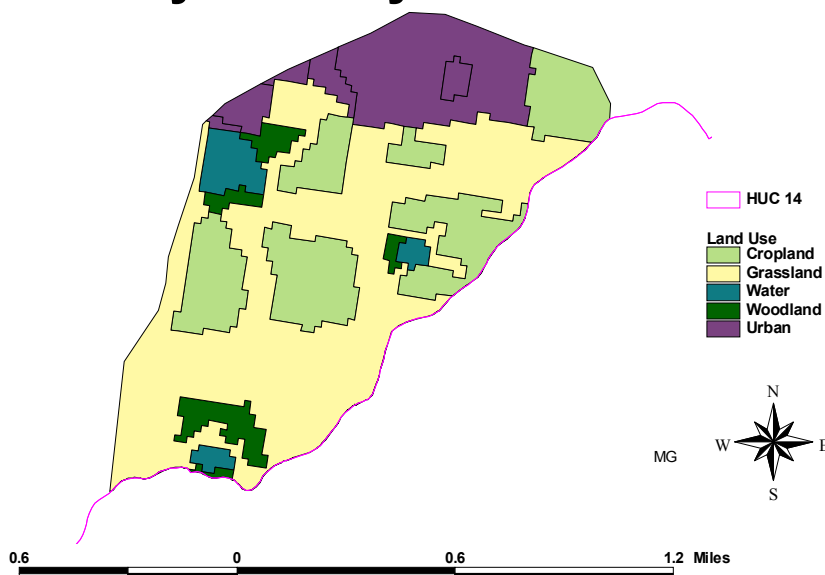
In order to improve the trophic condition of the lake from its current hypereutrophic status, the desired endpoint will be to maintain summer chlorophyll a concentrations at or below 12 $\mu\text{g/L}$. Refined endpoints will be developed in 2007 to reflect additional sampling and artificial source assessment and confirmation of impaired status of lake.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: The watershed around Cherryvale City Lake has a moderate potential for nonpoint source pollutants. An annual phosphorus load of 1,215 pounds per year is necessary to correspond to the concentrations seen in the lake (Appendix C).

Figure 2

Cherryvale City Lake Land Use



Phosphorus from animal waste is a contributing factor. Fifty-one percent of land around the lake is grassland (Figure 2). The grazing density of livestock is moderate in summer and winter. Another source of phosphorus within Cherryvale City Lake is probably runoff from agricultural lands where nutrients have been applied. Land use coverage

analysis indicates that 24.4% of the watershed is cropland.

The Cherryvale City Lake watershed is 16.6% urban. Fertilizer applications to lawns within the drainage and stormwater delivery to the lake are probable loading sources. The population density is 55.6 people per square mile. The population of Cherryvale is expected to decrease 8.9% through 2020.

Contributing Runoff: The watershed's average soil permeability is 0.8 inches/hour according to NRCS STATSGO database. About 100% of the watershed produces runoff even under relatively low (1.5"/hr) potential runoff conditions. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the watersheds' soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.5"/hr of rain will generate runoff from only 5.5% of this watershed, chiefly along the stream channels.

Background Levels: Five percent of land in the watershed is woodland; leaf litter may be contributing to the nutrient loading. The atmospheric phosphorus and geological formations (i.e., soil and bedrock) may contribute to phosphorus loads. Carp may cause some resuspension of sediment.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

Phosphorus is allocated under this TMDL. The Load Capacity is 158 pounds per year of phosphorus. More detailed assessment of sources and confirmation of the trophic state of the lake must be completed before detailed allocations can be made. The general inventory of sources within the drainage does provide some guidance as to areas of load reduction.

Point Sources: A current Wasteload Allocation of zero is established by this TMDL because of the lack of point sources in the watershed. Should future point sources be proposed in the watershed and discharge into the impaired segments, the current wasteload allocation will be revised by adjusting current load allocations to account for the presence and impact of these new point source dischargers.

Nonpoint Sources: Water quality violations are predominantly due to nonpoint source pollutants. Background levels may be attributed to atmospheric and geological sources. The assessment suggests that animal waste, fertilizer applications to lawns and cropland, and stormwater delivery contribute to the elevated total phosphorus concentrations in the lake. Generally a Load Allocation of 142 pounds of total phosphorus per year, leading to an 86.9% reduction, is necessary to reach the endpoint.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus and the chlorophyll a endpoint. Therefore, the margin of safety will be 16 pounds per year of total phosphorus taken from the load capacity subtracted to compensate for the lack of knowledge about the relationship between the allocated loadings and the resulting water quality.

State Water Plan Implementation Priority: Because more data are needed to determine the trophic state of the lake, the Cherryvale City Lake TMDL will be a Low Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Middle Verdigris (HUC 8: 11070103) with a priority ranking of 26 (Medium Priority for restoration).

Priority HUC 11s: The watershed is within HUC 11 (010).

5. IMPLEMENTATION

Desired Implementation Activities

There is some potential for reducing pollutant loads to this lake through the use of agricultural and urban best management practices. Some of the recommended agricultural practices are as follows:

1. Implement soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain conservation tillage and contour farming to minimize cropland erosion.
3. Install grass buffer strips along streams.
4. Reduce activities within riparian areas.
5. Implement nutrient management plans to manage manure application to land.

Implementation Programs Guidance

Until the 2007 assessment of the continuation of monitoring is made, no direction can be made to those implementation programs.

Time Frame for Implementation: Continued monitoring over the years from 2002 to 2007.

Targeted Participants: Primary participants for implementation will be agricultural producers and residents of Cherryvale who are within the drainage of the lake. A detailed assessment of sources will be conducted by KDHE over 2002-2007.

Milestone for 2007: The year 2007 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Cherryvale City Lake will be reexamined to confirm the impaired status of the lake. Should the case of impairment remain, source assessment, allocation, and implementation activities will ensue.

Delivery Agents: Depending upon confirmation of impairment and assessment of probable sources, the primary delivery agents for program participation will be the City of Cherryvale, conservation districts for programs of the State Conservation Commission, and the Natural Resources Conservation Service.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollutants.

1. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.
2. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.
3. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.
4. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.
5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.
6. The *Kansas Water Plan* and the Verdigris Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

Funding: The State Water Plan Fund annually generates \$16-18 million and is the primary funding mechanism for implementing water quality protection and pollutant reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are a Low Priority consideration and should not receive funding until after 2007.

Effectiveness: Effectiveness of corrective actions will depend upon the sources which contribute to the impairment at the lake.

6. MONITORING

Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2007. Further sampling and evaluation should occur twice before 2007.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Verdigris Basin were held January 23 in Fredonia and March 6, 2002 in Neodesha. An active Internet Web site was established at <http://www.kdhe.state.ks.us/tmdl/> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Verdigris Basin.

Public Hearing: A Public Hearing on the TMDLs of the Verdigris Basin was held in Neodesha on June 4, 2002.

Basin Advisory Committee: The Verdigris Basin Advisory Committee met to discuss the TMDLs in the basin on October 3, 2001, January 23, March 6, and June 4, 2002.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:
Kansas Farm Bureau: February 26 in Fredonia

Milestone Evaluation: In 2007, evaluation will be made as to the degree of impairment which has occurred within the watershed and current condition of Cherryvale City Lake. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303(d) Delisting: The lake will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2007-2011. Therefore, the decision for delisting will come about in the preparation of the 2012 303(d) list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

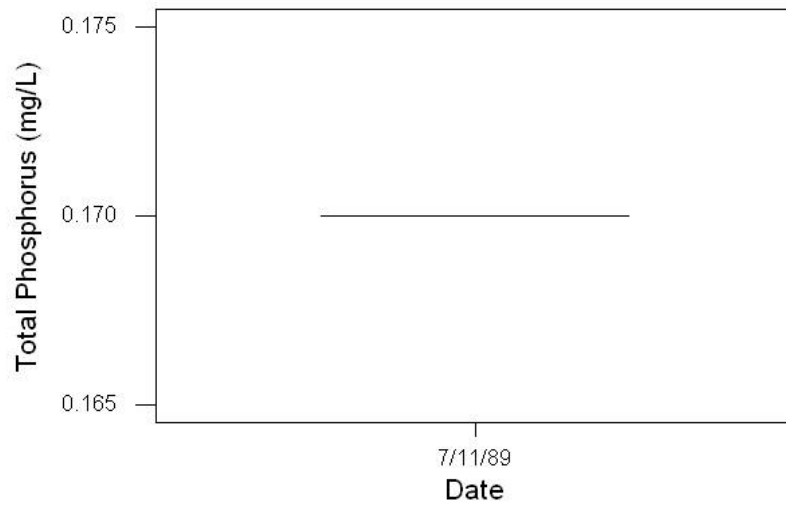
Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2003 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2003-2007.

Bibliography

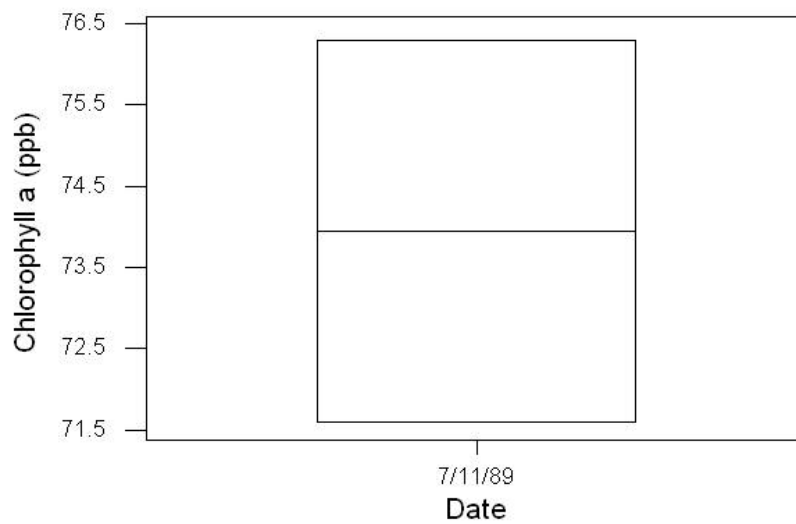
Liscek, Bonnie C. Methodology Used in Kansas Lake TMDLs [web page] Jul. 2001;
<http://www.kdhe.state.ks.us/tmdl/eutro.htm> [Accessed 17 May 2002].

Appendix A - Boxplots

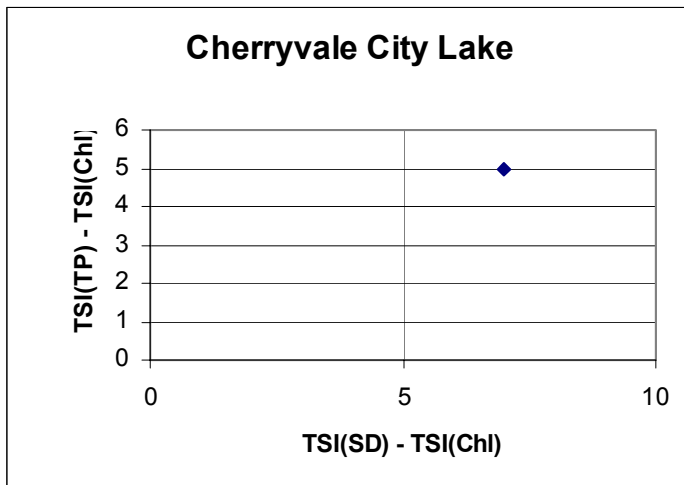
Cherryvale City Lake(Lake Tanko)



Cherryvale City Lake(Lake Tanko)



Appendix B - Trophic State Index Plots



This Trophic State Index Plot indicates that light is probably a limiting factor, due to clay turbidity.

Appendix C - Input for CNET Model

Parameter	Value Input into CNET Model
Drainage Area (km ²)	2.57
Precipitation (m/yr)	0.96
Evaporation (m/yr)	1.32
Unit Runoff (m/yr)	0.24
Surface Area (km ²)	0.06
Mean Depth (m)	0.80
Depth of Mixed Layer (m)	0.60
Depth of Hypolimnion (m)	0.17
Observed Phosphorus (ppb)	170.00
Observed Chlorophyll-a (ppb)	73.95
Observed Secchi Disc Depth (m)	0.25

Approved September 30, 2002